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RoHS Recast Compliant

M.2 2260 Flash Drive

H200-M Product Specifications

March 6, 2015

Version 1.0

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Features:

- **Standard SATA Interface Compliance**
  - Serial ATA Revision 3.1 compliance
  - SATA 6.0 Gbps interface
  - ATA-8 command set
- **Capacities**
  - 64, 128, 256, 512 GB
- **Performance***
  - Interface burst read/write: 600 MB/sec
  - Sustained read: up to 520 MB/sec
  - Sustained write: up to 380 MB/sec
- **Flash Management**
  - Built-in hardware ECC, enabling up to 72 bit correction per 1K bytes
  - Static/dynamic wear-leveling
  - Flash bad-block management
  - S.M.A.R.T.
  - Power Failure Management
  - ATA Secure Erase
  - TRIM
- **NAND Flash Type:** MLC
- **Temperature ranges**
  - Operating:
    Standard: 0°C to 70°C
    Extended: -40°C to +85°C
  - Storage: -40°C to 85°C
- **Supply voltage**
  - 3.3 V ± 5%
- **Power consumption (typical)***
  - Active mode: 2,250 mW
  - Idle mode: 250 mW
- **Connector type**
  - 75-pin SATA-based M.2 module pinout
- **Form factor**
  - M.2 2260 form factor
  - Dimensions: 60.00x 22.00x3.88, unit: mm
- **Shock & Vibration*****
  - Shock:1500 G
  - Vibration: 15 G
- **MTBF:** >1,000,000 hours
- **RoHS Recast compliant (complies with 2011/65/EU standard)**

*Varies from capacities. The values for performances and power consumptions presented are typical and may vary depending on flash configurations or platform settings. The term idle refers to the standby state of the device.
**Non-operating

Table of Contents

1.General Description

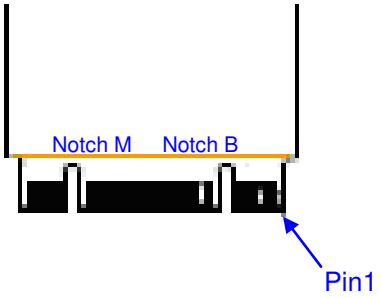
Apacer's H200-M is the next generation modularized Solid State Drive (SSD) with the shape of all new M.2 form factor, aimed to be the more suitable for mobile and compact computers with standard width at only 22.00 mm. H200-M appears in M.2 2260 mechanical dimensions and is believed to be the leading add-in storage solution for future host computing systems.

The M.2 SSD is designed with SATA-based connector pinouts, providing full compliance with the latest SATA Revision 3.1 interface specifications. Aside from SATA compliance, H200-M delivers exceptional performance and power efficiency. On the other hand, the extreme thin and light form factor makes H200-M the ideal choice for mobile computing systems, which appears to be the trend in near future.

Regarding reliability, H200-M is built with a powerful SATA controller that supports on-the-module ECC as well as efficient wear leveling scheme. In terms of power efficiency, H200-M is compliant with SATA 6.0 Gbps interface standard so that it can operate on SATA power management modes, which greatly save on power consumption.

2. Pin Assignments

This connector does not support hot plug capability. There are a total of 75 pins. 12 pin locations are used for mechanical key locations; this allows such a module to plug into both Key B and Key M connectors.



Pin	Type	Description
1	CONFIG_3	Ground (according to M.2 configurations for SSD-SATA definition)
2	3.3V	Supply Pin, 3.3V
3	GND	Ground
4	3.3V	Supply pin, 3.3V
5	No connect	No connect
6	Not available	No connect (used for other purposes)
7	Not available	No connect (used for other purposes)
8	Not available	No connect (used for other purposes)
9	No connect	No connect
10	DAS/DSS	Device Activity Signal/Disable Staggered Spin-up

11	No connect	No connect (used for other purposes)
12	Module key	
13	Module key	
14	Module key	
15	Module key	
16	Module key	
17	Module key	
18	Module key	
19	Module key	
20	Not available	No connect (used for other purposes)
21	CONFIG_0	Ground (according to M.2 configurations for SSD-SATA definition)
22	Not available	No connect (used for other purposes)
23	Not available	No connect (used for other purposes)
24	Not available	No connect (used for other purposes)
25	Not available	No connect (used for other purposes)
26	Not available	No connect (used for other purposes)
27	GND	Ground
28	Not available	No connect (used for other purposes)
29	Not available	No connect
30	Not available	No connect (used for other purposes)
31	Not available	No connect
32	Not available	No connect (used for other purposes)
33	GND	Ground
34	Not available	No connect (used for other purposes)
35	Not available	No connect
36	Not available	No connect (used for other purposes)
37	Not available	No connect
38	Not available	No connect
39	GND	Ground
40	Not available	No connect (used for other purposes)
41	SATA-Rx+	Host receiver differential signal pair
42	Not available	No connect (used for other purposes)
43	SATA-Rx-	Host receiver differential signal pair
44	Not available	No connect (used for other purposes)
45	GND	Ground
46	Not available	No connect (used for other purposes)
47	SATA-Tx-	Host transmitter differential pair

48	Not available	No connect (used for other purposes)
49	SATA-Tx+	Host transmitter differential pair
50	Not available	No connect
51	GND	Ground
52	Not available	Not used
53	Not available	Not used
54	Not available	Not used
55	Not available	Not used
56	Reserved for MFG Data	Manufacturing Data line. Used for SSD manufacturing only. Not used in normal operation. Pins should be left N/C in platform Socket.
57	GND	Ground
58	Reserved for MFG clock	Manufacturing Clock line. Used for SSD manufacturing only. Not used in normal operation. Pins should be left N/C in platform Socket
59	Module key	
60	Module key	
61	Module key	
62	Module key	
63	Module key	
64	Module key	
65	Module key	
66	Module key	
67	Not available	No connect (used for other purposes)
68	SUSCLK	32 kHz clock supply input that is provided by PCH to reduce power and cost for the module
69	CONFIG_1	Defines module type
70	3.3V	Supply pin, 3.3V
71	GND	Ground
72	3.3V	Supply pin, 3.3V
73	GND	Ground
74	3.3V	Supply pin, 3.3V
75	CONFIG_2	Ground

3. Product Specifications

3.1 Capacity

Capacity specification of H200-M is available as shown in Table 3-1. It lists the specific capacity and the default numbers of heads, sectors and cylinders for each product line.

Table 3-1: Capacity specifications

Capacity	Total Bytes	Cylinders	Heads	Sectors	Max LBA
64 GB	64,023,257,088	16,383	16	63	125,045,424
128 GB	128,035,676,160	16,383	16	63	250,069,680
256 GB	256,060,514,304	16,383	16	63	500,118,192
512 GB	512,110,190,592	16,383	16	63	1,000,215,216

*Display of total bytes varies from file systems, which means not all of the bytes can be used for storage.
**Notes: 1 GB = 1,000,000,000 bytes; 1 sector = 512 bytes.
LBA count addressed in the table above indicates total user storage capacity and will remain the same throughout the lifespan of the device. However, the total usable capacity of the SSD is most likely to be less than the total physical capacity because a small portion of the capacity is reserved for device maintenance usages.

3.2 Performance

Performances of H200-M are listed below in table 3-2.

Table 3-2: Performance

Performance \ Capacity	64 GB	128 GB	256 GB	512 GB
Sustained read (MB/s)	520	520	520	520
Sustained write (MB/s)	190	350	370	380

Note: Results were measured by CrystalDiskMark benchmark and may differ from various flash configurations or host system setting

3.3 Environmental Specifications

Environmental specification of H200-M series follows MIL-STD-810 standards as shown in Table 3-3.

Table 3-3 H200-M environmental specifications

Item	Specification
Operating temperature	0℃~70℃(standard) ; -40℃~85℃(extended) ;
Non-operating temperature	-40℃~85℃
Operating humidity	40℃, 90%RH
Non-operating humidity	40℃, 93%RH
Vibration (Non-operating)	Frequency/Displacement: 20Hz~80Hz/1.52mm Frequency/Acceleration: 80Hz~2000Hz/20G X, Y, Z axis/30mins
shock (Non-operating)	500G, 2ms
Drop (Non-operating)	110cm free fall, 6 face of each unit
Bending (non-operating)	≧10N, hold 1min/5times
Torque (non-operating)	0.5N-m or 5 deg, hold 5min/5times
ESD (Electrostatic)	Passed (at relative temp/humidity: 24℃, 49%RH)

3.4 Mean Time Between Failures (MTBF)

Mean Time Between Failures (MTBF) is predicted based on reliability data for the individual components in H200-M. The prediction result for H200-M is more than 1,000,000 hours.

Notes about the MTBF:

The MTBF is predicated and calculated based on “Telcordia Technologies Special Report, SR-332, Issue 2” method.

3.5 Certification and Compliance

H200-M complies with the following standards:

- CE
- FCC
- BSMI
- RoHS Recast

4. Flash Management

4.1 Error Correction/Detection

H200-M implements a hardware ECC scheme, based on the BCH algorithm. It can detect and correct up to 72 bits error in 1K bytes.

4.2 Bad Block Management

Bad blocks are blocks that include one or more invalid bits, and their reliability is not guaranteed. Blocks that are identified and marked as bad by the manufacturer are referred to as “Initial Bad Blocks”. Bad blocks that are developed during the lifespan of the flash are named “Later Bad Blocks”. Apacer implements an efficient bad block management algorithm to detect the factory-produced bad blocks and manages any bad blocks that appear with use. This practice further prevents data being stored into bad blocks and improves the data reliability.

4.3 Wear Leveling

NAND flash devices can only undergo a limited number of program/erase cycles, and in most cases, the flash media are not used evenly. If some areas get updated more frequently than others, the lifetime of the device would be reduced significantly. Thus, Wear Leveling is applied to extend the lifespan of NAND flash by evenly distributing write and erase cycles across the media.

Apacer provides advanced Wear Leveling algorithm, which can efficiently spread out the flash usage through the whole flash media area. Moreover, by implementing both dynamic and static Wear Leveling algorithms, the life expectancy of the NAND flash is greatly improved.

4.4 Power Failure Management

Power Failure Management is a mechanism to prevent data loss during unexpected power failure. DRAM is a volatile memory and frequently used as temporary cache or buffer between the controller and the NAND flash to improve the SSD performance. However, one major concern of the DRAM is that it is not able to keep data during power failure. Accordingly, H200-M applies the flush mechanism, which requests the controller to transfer data to the cache. For H200-M, DDR performs as a cache. Only when the data is fully committed to the NAND flash will the controller send acknowledgement (ACK) to the host. Such implementation can prevent false-positive performance and the risk of power cycling issues.

Additionally, it is critical for a controller to shorten the time the in-flight data stays in the cache. Thus, H200-M applies an algorithm to reduce the amount of data resides in the cache to provide a better performance. This algorithm allows incoming data to only have a “pit stop” in the cache and then move to the NAND flash at once. If the flash is jammed due to particular file sizes (such as random 4KB data), the cache will be treated as an “organizer”, consolidating incoming data into groups before written into the flash to improve write amplification.

In sum, Power Failure Management proves to provide the reliability required by consumer, industrial, and enterprise-level applications.

4.5 ATA Secure Erase

ATA Secure Erase is a standard ATA command and will write all “0xFF” to fully wipe all the data on hard drives and SSDs. When this command is issued, the SSD controller will empty its storage blocks and return to its factory default settings.

4.6 TRIM

TRIM is a feature which helps improve the read/write performance and speed of solid-state drives (SSD). Unlike hard disk drives (HDD), SSDs are not able to overwrite existing data, so the available space gradually becomes smaller with each use. With the TRIM command, the operating system can inform the SSD which blocks of data are no longer in use and can be removed permanently. Thus, the SSD will perform the erase action, which prevents unused data from occupying blocks all the time.

4.7 SATA Power Management

By complying with SATA 6.0 Gb/s specifications, the SSD supports the following SATA power saving modes:

- ACTIVE: PHY ready, full power, Tx & Rx operational
- PARTIAL: Reduces power, resumes in under 10 µs (microseconds)
- SLUMBER: Reduces power, resumes in under 10 ms (milliseconds)
- HIPM: Host-Initiated Power Management
- DIPM: Device-Initiated Power Management

Note:
1. The behaviors of power management features would depend on host/device settings.

5. Software Interface

5.1 Command Set

Table 5-1: Command set

Command	Code	Command	Code
CHECK Power Mode	E5h	Security Disable Password	F6h
Data Set Management	06h	Security Erase Prepare	F3h
DCO	B1h	Security Erase Unit	F4h
Download Microcode PIO	92h	Security Freeze Lock	F5h
Download Microcode DMA	93h	Security Set Password	F1h
Execute Drive Diagnostic	90h	Security Unlock	F2h
Flush Cache	E7h	Seek	70h
Flush Cache Ext	Eah	Set Features	Efh
Identify Device	Ech	Set Max Address	F9h
Idle	E3h	Set Max Address Ext	37h
Idle Immediate	E1h	Set Multiple Mode	C6h
Initialize Drive Parameters	91h	Sleep	E6h
Read Buffer	E4h	SMART	B0h
Read DMA (W/O retry)	C9h	Standby	E2h
Read DMA (W/ retry)	C8h	Standby Immediate	E0h
Read DMA Ext	25h	Write Buffer	E8h
Read FPDMA Queued	60h	Write DMA (W/O retry)	CBh
Read Log Ext	2Fh	Write DMA (W/ retry)	Cah
Read Multiple	C4h	Write DMA Ext	35h
Read Multiple Ext	29h	Write DMA FUA Ext	3Dh
Read Native Max Address	F8h	Write FPDMA Queued	61h
Read Native Max Ext	27h	Write Log Ext	3Fh
Read Sector(s) (W/O retry)	21h	Write Multiple	C5h
Read Sector(s) (W/ retry)	20h	Write Multiple Ext	39h
Read Sector(s) Ext	24h	Write Multiple FUA Ext	Ceh
Read Verify Ext	42h	Write Sector(s) (W/O retry)	31h
Read Verify Sector(s) (W/O retry)	41h	Write Sector(s) (W/ retry)	30h
Read Verify sector(s) (W/ retry)	40h	Write Sector(s) Ext	34h
Recalibrate	10h	Write Uncorrectable	45h

5.2 S.M.A.R.T.

SMART, an acronym for Self-Monitoring, Analysis and Reporting Technology, is an open standard that allows a hard disk drive to automatically detect its health and report potential failures. When a failure is recorded by SMART, users can choose to replace the drive to prevent unexpected outage or data loss. Moreover, SMART can inform users of impending failures while there is still time to perform proactive actions, such as copy data to another device.

6. Electrical Specification

Table 6-1: Operating range

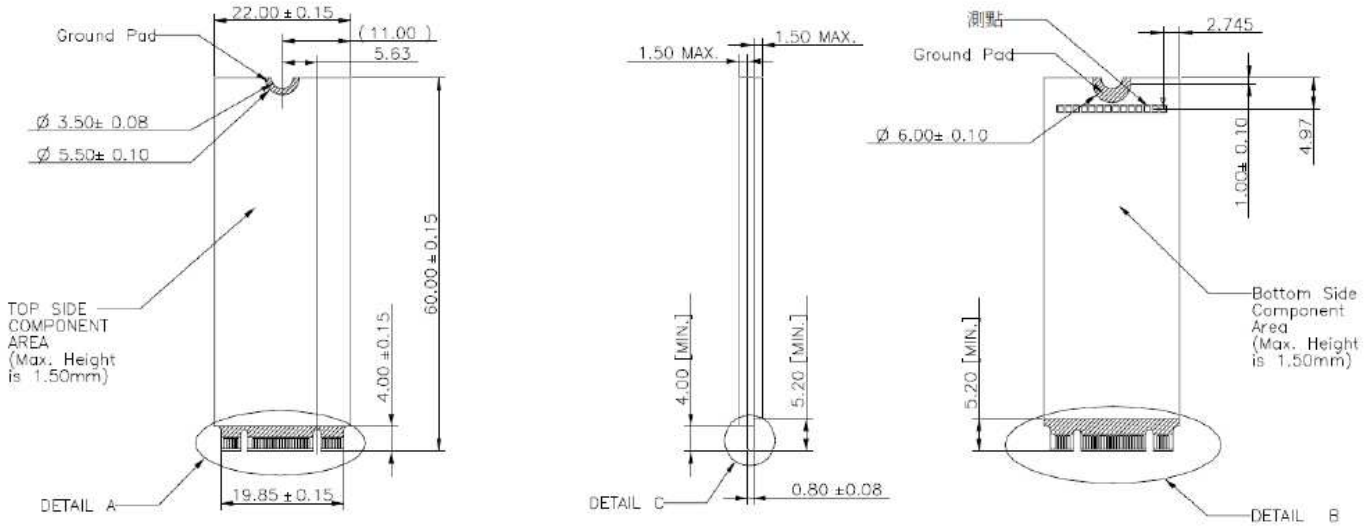
Supply Voltage	3.3V±5% (3.135-3.465V)

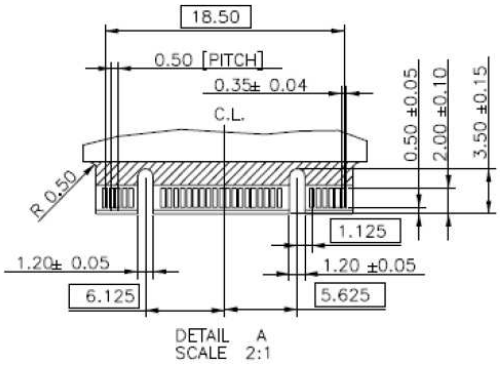
Table 6-2: Typical power consumption

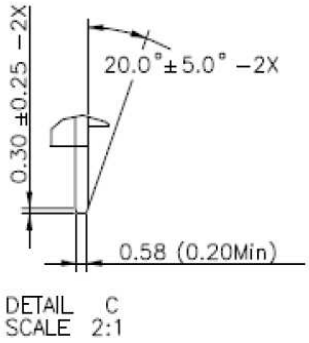
Capacity / Modes	64 GB	128 GB	256 GB	512 GB
Active (mW)	1485	1620	1630	2250
Idle (mW)	220	230	250	250

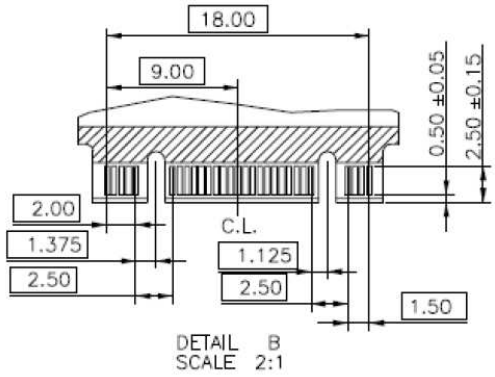
Note: Results may differ from various flash configurations or host system setting

7. Mechanical Specifications





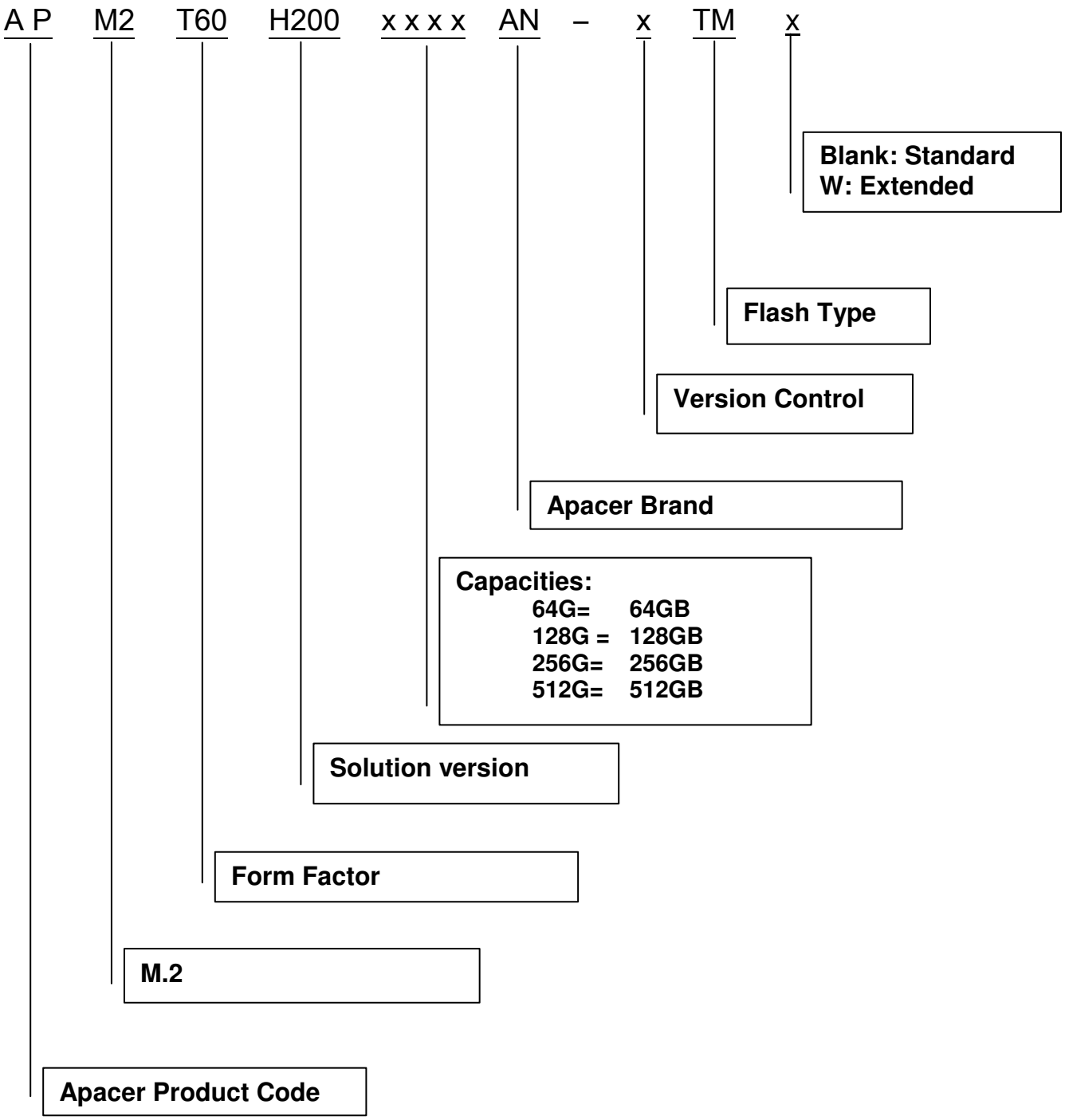




Unit: mm
Tolerance: ± 0.25

8. Product Ordering Information

8.1 Product Code Designations



8.2 Valid Combinations

Capacity	Standard	Extended
64GB	APM2T60H200064GAN-3TM	APM2T60H200064GAN-3TMW
128GB	APM2T60H200128GAN-3TM	APM2T60H200128GAN-3TMW
256GB	APM2T60H200256GAN-3TM	APM2T60H200256GAN-3TMW
512GB	APM2T60H200512GAN-3TM	APM2T60H200512GAN-3TMW

Note: Valid combinations are those products in mass production or will be in mass production. Consult your Apacer sales representative to confirm availability of valid combinations and to determine availability of new combinations.

Revision History

Revision	Date	Description	Remark
1.0	03/06/2015	Official release	

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